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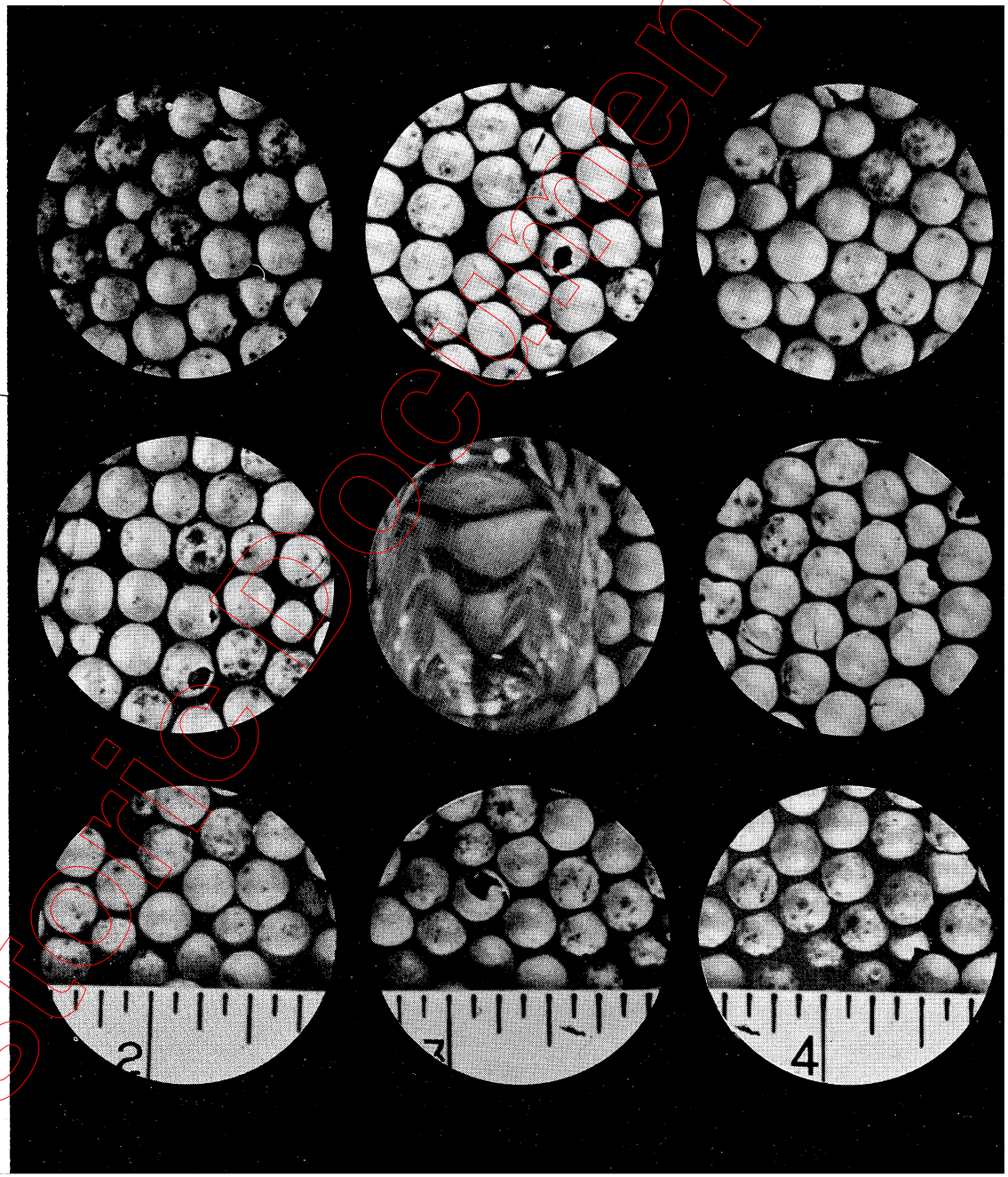

Cooperative Extension Service
PURDUE UNIVERSITY
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Crambe—a potential new crop for Indiana

E. P. Christmas, K. J. Lessman, C. B. Southard, and M. W. Phillips

Crambe at 25 days

Crambe—a potential new crop for Indiana

Introduction

Crambe shows promise as a new industrial oil seed crop in Indiana. It is a result of a search for new crops to further diversify agriculture and to provide new raw materials for industry. Crambe seed is valued as a source of oil high in erucic acid. The erucic acid oil currently used in American industry is extracted from imported rapeseed. Therefore, Crambe oil would not compete directly with domestic seed oils. At the present time, there is no broad commercial outlet for Crambe seed in Indiana, and it is not recommended that Crambe be grown unless the producer has a market for his production.

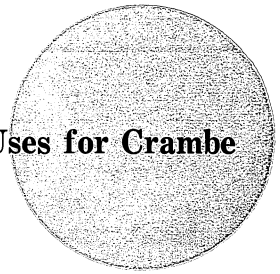
Nature of the Crambe Plant

Crambe abyssinica Hochst. is classified under the genus *Crambe* and the family *Cruciferae* (mustard family). Throughout the remainder of this publication, the generic name, Crambe, will be used as the common name and will refer to the species *Crambe abyssinica*. Crambe is closely related to the rapes and mustards. It is an erect annual herb, having numerous branches and growing to a height of 24 to 36 inches. Crambe leaves are large, oval shaped and smooth. Its flowers are very small, white and numerous with indeterminate flowering. The one seeded fruits are spherical in shape. The pericarp, hereafter referred to as pod, remains on the seed at harvest and is considered a part of the harvested product[1].

History of Crambe

Crambe is believed to be a native of the Mediterranean area. It's seed was first introduced into this country by the Connecticut Agricultural Experiment Station in the 1940's[2]. Earnest evaluations of a number of strains of Crambe began in Texas in 1958. The first detailed work with Crambe in Indiana began in 1962. A number of other states in the United States have tested the potentials of Crambe

including: Iowa, Nebraska, Kansas, North Carolina, Missouri, Minnesota, Oregon, Pennsylvania, South Dakota, North Dakota, Montana and Wyoming[1]. Since about 1932, Crambe has been tested in many areas of the world. Countries reporting experiments with Crambe are: Canada, Denmark, Germany, Lithuania, Poland, Russia, Sweden and Venezuela[2].



Uses for Crambe

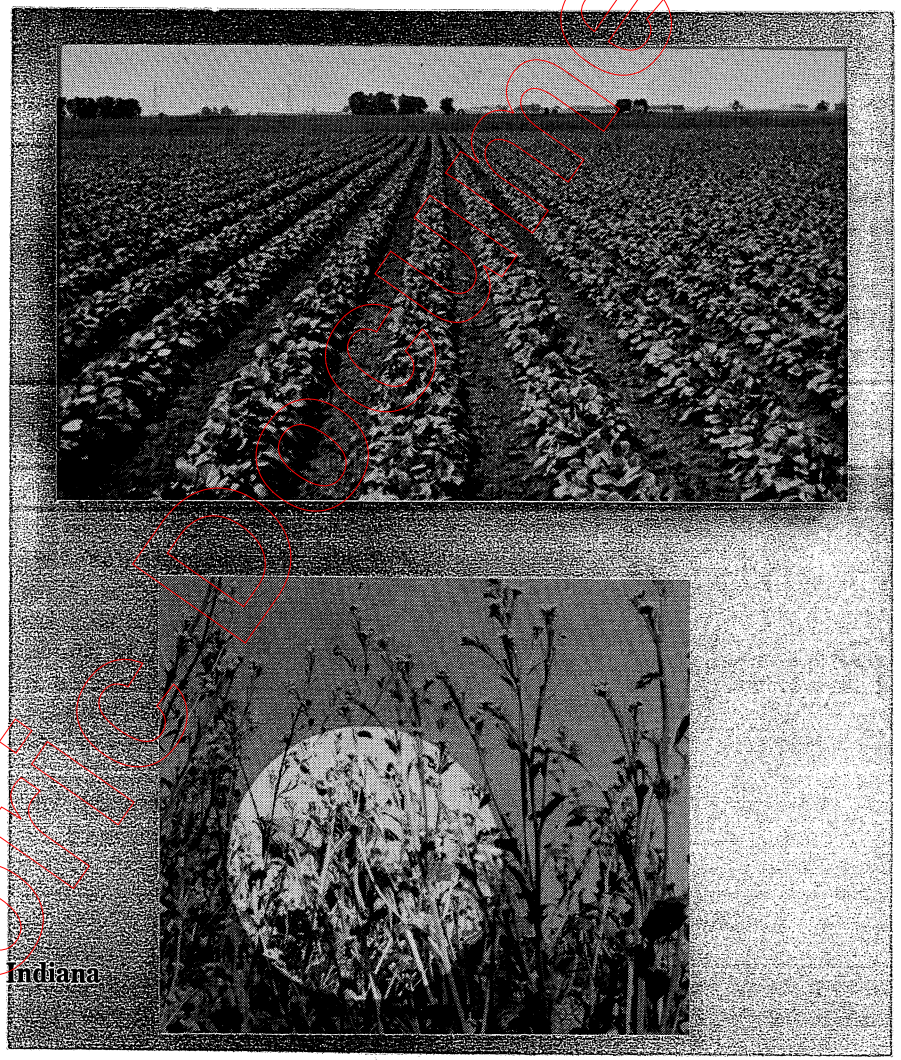
Crambe seed with the pod still attached contains from 26 to 38 percent oil with 32 percent being about average[3]. Most Crambe oil samples will range from 51 to 60 percent erucic acid. Chemists at the Northern Utilization Research and Development Division of the Agricultural Research Service at Peoria, Illinois, have developed a number of potential industrial uses for this oil. The oil, as extracted from the seed and refined, can be used as a mold lubricant in the continuous casting of steel, in the manufacture of rubber additives, as a lubricant and as a possible ingredient of waxes.

The erucic acid can be purified from the Crambe oil and by ozonalysis split into brassylic acid and pelargonic acid. Brassylic acid is not available at the present time in sufficient quantities to permit its widespread use in industry. Potential markets for brassylic acid are in the making of nylon-type fibers, plasticizers, polyesters, alkyd resins, lubricants and surface-active agents. Pelargonic acid, on the other hand, is currently available for industrial uses and is used for the production of jet-engine lubricants, plasticizers, alkyd resins, vinyl stabilizers, flotation agents, insect repellants, pharmaceutical and other synthetic chemicals. Other components of Crambe oil also have definite market potentials.

The primary by-product of the oil extraction process is a seed meal containing 25 to 35 percent protein when the pod is included. If the pod is removed, the protein content of the oil-free meal will run from 46 to 58 percent. In 1966, thirty-six oil-free meal samples (pod excluded) from Indiana-grown Crambe were analyzed for protein and had an average content of 50.7 percent. The amino acid composition of the protein rich Crambe meal indicates that it is potentially a source of high quality protein for livestock feed. Untreated, oil-free Crambe meal contains 8 to 10 percent thioglucosides which is toxic to single stomach animals, such as hogs and chickens. A number of processes are being investigated to either neutralize or remove the toxic materials from the Crambe meal during oil extraction. Experimental work at the University of Nebraska indicates that up to one-third of the soybean meal in cattle rations can be replaced with the untreated Crambe meal without altering weight gains. Higher levels of Crambe meal decreased feed consumption and weight gains.

Crambe Suited to Indiana Climate

Crambe is a cool-season crop that seems to be well adapted to the climatic conditions prevailing in Indiana. About 90 to 100 days are required from the date of planting to maturity. It can tolerate low temperatures prior to seed set. During the spring of 1966, Crambe plantings were subjected to 23°F temperatures on April 1 without any visible damage. However, early August seedings in the Vincennes area were killed by a 19°F freeze on November 2, 1966.



Crambe Field in Indiana

Well drained, fertile soils of moderately coarse to fine textures are well suited to Crambe production. Observations made in the Vincennes area during the spring and summer of 1966 and 1967 indicate that Crambe will not tolerate wet or waterlogged soils, but seems to be able to withstand moderate drought conditions.

Recommended Cultural Practices

Seed-Bed Preparation

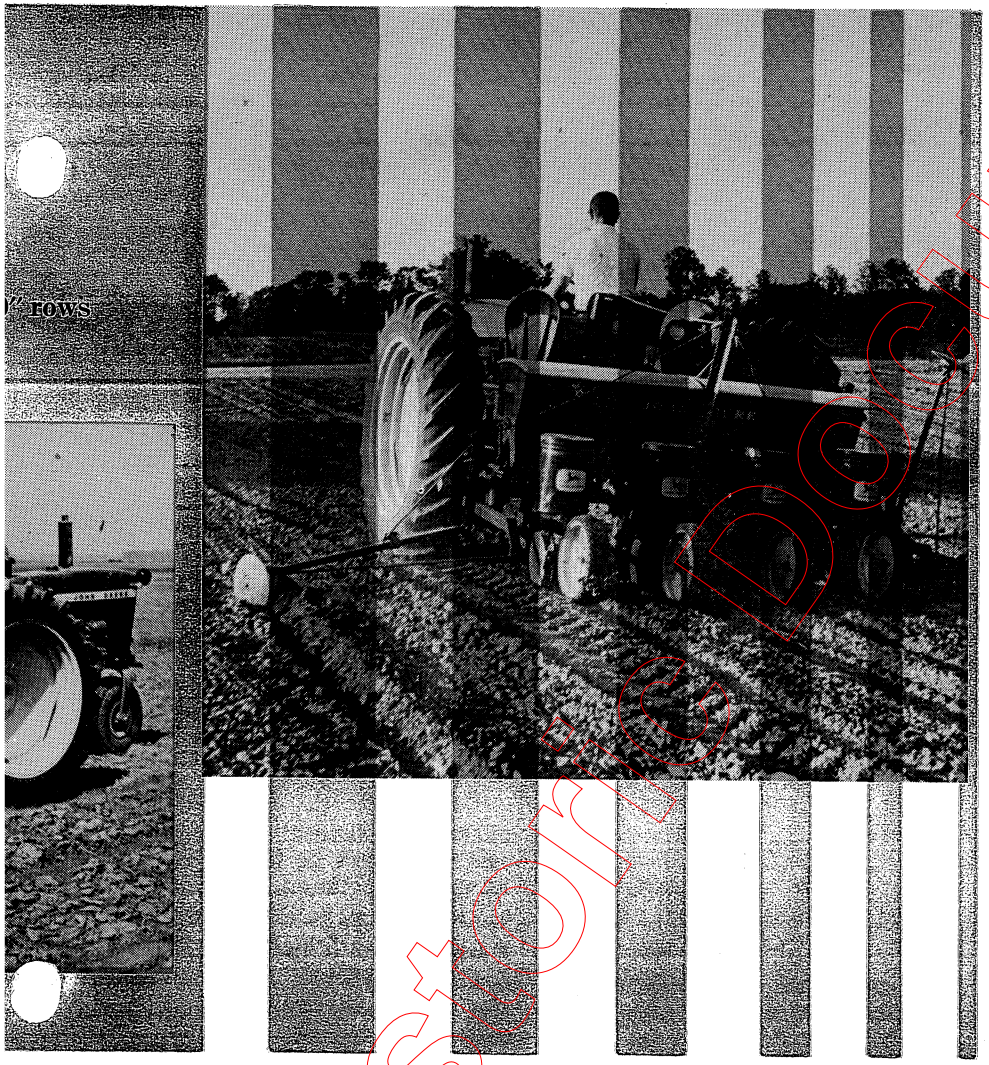
The seed-bed for Crambe should be prepared in a manner very similar to that of a fall seeded alfalfa crop. That is, the soil should be plowed and disced and then worked with either a land leveler or a cultipacker and heavy drag. The smoothing and packing operation is usually essential to provide a smooth but firm seed-bed and to assure the placement of seed at a uniform depth. A few farmers have disced and smoothed soybean stubble fields for planting with satisfactory results.

Some farmers are attempting to grow Crambe following wheat. Where this is attempted the straw should be removed or a chopper used on the combine at harvest and then a seed-bed can be prepared by discing the wheat stubble. This method will help conserve moisture present in the soil when the wheat is combined.

Planting Date

Crambe can be planted as early in the spring as possible after the threat of temperatures below 24°F has passed. In southern Indiana, this corresponds to a date around April 1; in northern Indiana, it would be around April 15. No serious frost damage has occurred the past two years to Crambe planted on March 31 and April 1 in southern Indiana. Observations indicate that high yields are usually associated with early planting in southern Indiana, whereas mid-May and June plantings frequently result in low yields.

Crambe may be seeded solid or in



The growing season in southern Indiana is sufficiently long to permit two crop possibilities. Approximately 300 acres of Crambe were seeded in the summer of 1967 in an attempt to verify the feasibility of a second crop. This second crop was seeded either following wheat harvest or the harvest of the first crop of Crambe. If a second crop is attempted, it should be planted around mid July or as soon after wheat or Crambe harvest as possible.

Methods of Seeding

Crambe may be seeded solid or in rows depending on the equipment available. For solid seeding, a wheat drill or cultipacker seeder may be used. The wheat drill has been the most popular and has given very good results where the seed-bed was smooth and firm. Since solid seeded Crambe cannot be cultivated, it should be grown on soils where weeds are not a problem or where a herbicide is used at planting time.

Where Crambe is planted in rows, a 20 to 30 inch corn planter can be used. When planted in rows wider than 30 inches, Crambe will tend to lodge, making harvest a little difficult. The desired seeding rate can be obtained with corn, soybean or sorghum plates.

Depth of Planting

Planting depth is probably the most critical factor in obtaining a good stand of Crambe. The desired planting depth for Crambe is ¾ inch, and it should not be planted over 1 inch deep. A cultipacker seeder does an excellent job of placing the seed at the appropriate depth with no special care or attention. Where a wheat drill is used to seed Crambe, the tension should be taken off the disks and they should be permitted to float. A hydraulically controlled drill will give fewer problems, but the older type drills have been used with excellent results, provided care is taken in the adjustment. With a ¾ inch seeding depth, a few seeds may be visible on the surface. When a corn planter is used to seed Crambe, runners adjusted to ¾ inch or ¾ inch depth bands assure uniform and shallow planting depths.

Seeding Rates

Seeding rates from 5 to 35 pounds per acre have been used with little difference in yield reported. The most important point with regard to rate of seeding is to obtain a uniform rate that is dense enough to keep weeds and grass under control. A seeding rate of at least 20 pounds per acre of unhulled seed seems to give good results. If seed of less than 90 percent germination is used, the seeding rate should be increased accordingly.

Fertilization

Specific data on Crambe fertilization on Indiana soils is not available at this time. However, it appears that the phosphorus and potassium recommendations suggested for small grains are adequate for Crambe. A soil test is recommended to determine the optimum fertilization rate. For soils showing a medium test in phosphorus and potassium, approximately 60 pounds of P_2O_5 and 60 pounds of K_2O would be recommended per acre as a broadcast application.

Crambe also responds to nitrogen fertilization. A rate of approximately 100 pounds of actual nitrogen per acre appears to give a good response. This rate would need to be adjusted up or down, depending on the previous crop, fertilizer carry-over, soil color and texture of the soil. A soil pH of 6.0 to 7.0 appears to be adequate for Crambe production.

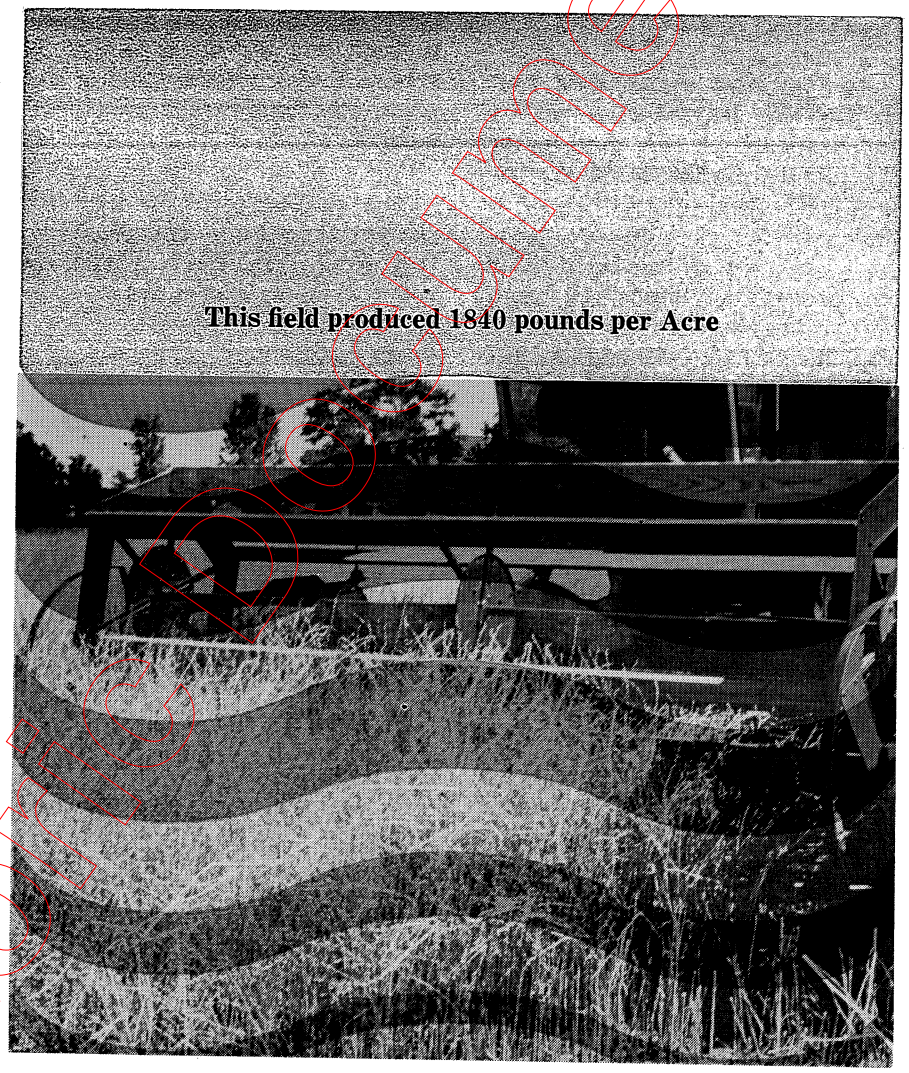
Weed Control

Competition from weeds is currently one of the most serious problems in the production of Crambe. Some of the weeds that have caused difficulties in southern Indiana are: pigweed, foxtail, smartweed, lambsquarter, ragweed, jimsonweed and velvetleaf. As was previously

mentioned, a uniform, thick stand of solid seeded Crambe is a very effective means of combating the weed problem. Also, early planting will put Crambe well ahead of the previously mentioned weeds since their seeds require a higher soil temperature for germination. If possible, Crambe should be planted in fields where weeds are not normally a major problem. Where necessary, Crambe can be planted in 20 to 30 inch rows and cultivated as a means of controlling weeds.

Chemical weed control for Crambe appears to be feasible. During the 1966 growing season, nine herbicide treatments were applied to two field plots in southern Indiana. Of the herbicides evaluated, pre-emergence applications of DCPA (Dacthal) at 6 pounds per acre, CP-31393 (Ramrod) at 4 pounds per acre, or a combination of the two at 3 pounds per acre and 2 pounds per acre respectively, gave the best weed control in Crambe.[4]

Crambe is very susceptible to injury from 2,4-D drift and the residual effects of Atrazine.



This field produced 1840 pounds per Acre

Harvesting

As Crambe approaches maturity, the leaves turn yellow and drop off. A few days after the last leaves have fallen, the seed pods and small branches turn a light golden or straw color. As soon as this light color has progressed down the stem below the last seed bearing branches, approximately half way, the seed should be ready to combine. A few isolated plants with sterile florets will remain green a little longer than the normal plants and should be ignored. Indiana grown Crambe has been combined direct, but in the Northwest it is necessary to swath it to facilitate drying. If the Crambe is standing good, it may be cut 12 to 18 inches high. The seed should be harvested with the pods attached.

Several different makes of combines have been used to harvest Crambe in Indiana. From observing these combines, it appears that a cylinder speed of from 400 to 500 R.P.M. and a concave clearance of ⅜ inch is most desirable. The air should be set as low as possible, but never disconnect the fan so as to shut the air off entirely. A screen size or riddle opening appropriate for Crambe should be used.

The reel should be slowed down to eliminate the possibilities of shattering. A pick-up reel will cause excess shattering.

Disease and Insect Pests

Crambe is relatively free of disease and insect pests. Mid-May and June plantings of Crambe in southern Indiana have been attacked by a disease which darkens the seed and stems. The condition may be caused by the fungus *Alternaria circinans*, but it has not been verified. This problem did not occur on Crambe planted in April.

The only insect observed in Indiana Crambe fields was the adult of the imported cabbage worm. There was no observable damage to the Crambe as a result of this insect.

Economics of Crambe Production

The yield levels of Crambe grown in southwestern Indiana by commercial farmers in 1966 and 1967 ranged from a high of 1850 pounds per acre to a low of 350 pounds per acre and averaged 1150 pounds per acre of clean seed. Yields in excess of 2000 pounds per acre have been obtained in Indiana on small plots of an acre or less.

The costs of producing Crambe is approximately the same as for wheat, since the same equipment and methods are used.

The price of the Crambe seed will be dependent primarily upon the market value of the extracted oil. The by-product, seed meal, has little market value at the present time, but this may change as soon as current livestock feeding trials have been completed. To compete with other crops, the price for Crambe seed, with pods attached, should be in the neighborhood of 5 cents per pound to the grower.

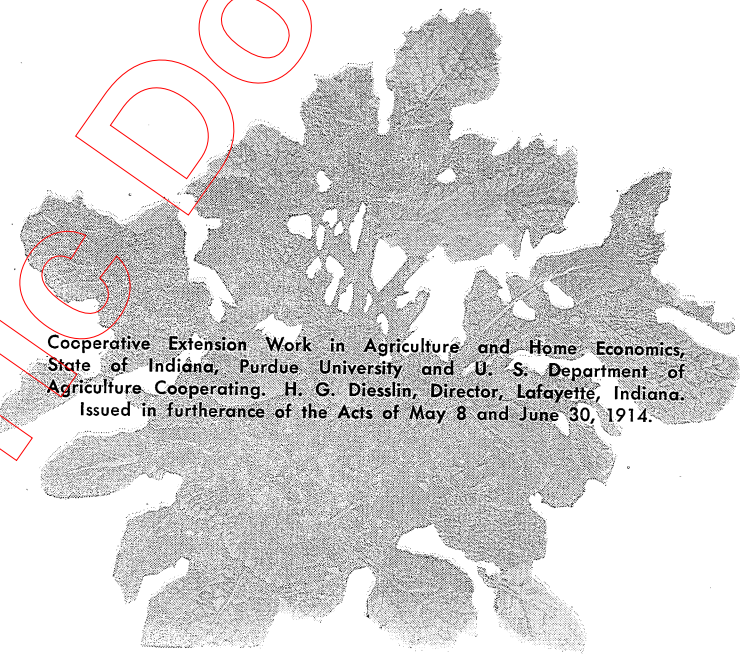
At this price, an 1800 pound yield would give a gross return of $90.00 per acre.

(1) Papathanasiou, G. A. and Lessman, K. J., 1966. "Crambe," Purdue University Research Bulletin No. 819.

(2) White, George A. and Higgins, J. J., 1966. "Culture of Crambe —A New Industrial Oilseed Crop," U.S.D.A. Agricultural Research Service Production Research Report No. 95.

(3) Earle, F. E., Peters, J. E., Wolfe, I. A. and White, G. A., 1965. "Compositional Differences Among Crambe Samples and Between Seed Components," Reprint from the Journal of American Oil Chemists' Society, Vol. 43, No. 5, pp. 330-333.

(4) Ross, Merrill A. and Williams, James L. Jr., 1966. "Herbicides for Weed Control in Crambe Production," Unpublished data Purdue University.



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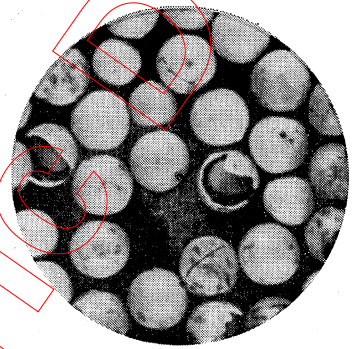

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